

IN THE CLAIMS:

1 1. (Original) A method for generating lookup tables and a final equivalence set for use in
2 classifying a network packet in accordance with a policy that specifies one or more
3 classes, each class containing one or more match statements, the match statements being
4 one of a stand-alone matching rule and a matching rule in an access control list (ACL)
5 defining one or more matching rules, the method comprising the steps of:

6 generating a super class that contains all of the matching rules associated with the
7 classes specified by the policy; and

8 converting the matching rules of the super class into a single, hierarchical ar-
9 rangement of lookup tables and associated equivalence sets, the hierarchical arrangement
10 having a plurality of levels including a first level and a final level, the final equivalence
11 set being associated with the final level.

1 2. (Original) The method of claim 1 wherein the step of generating a super class com-
2 prises the step of:

3 saving class information associated with each class.

1 3. (Original) The method of claim 2 wherein the class information includes for each
2 class:

3 a class name that identifies the class;

4 a class criterion associated with the class; and

5 a bitmap representing the matching rules associated with the class.

1 4. (Original) The method of claim 1 wherein the network packet is organized into a plu-
2 rality of sections and the step of converting comprises the steps of:

3 generating a first-level lookup table and a first-level equivalence set for each net-
4 work packet section using the matching rules of the super class;

5 merging the first-level equivalence sets to produce one or more next-level lookup
6 tables and next-level equivalence sets; and

7 merging the equivalence sets for each level to produce one or more next-level
8 lookup tables and next-level equivalence sets until the lookup table associated with final
9 level is produced.

1 5. (Original) The method of claim 4 wherein each network packet section is associated
2 with a value and the step of generating the first-level lookup tables and first-level equivalence sets comprises the steps of:

3 creating a bitmap that represents the matching rules associated with a respective
4 network packet section's value;

5 determining if the bitmap matches an entry in the first-level equivalence set and,
6 if so, assigning an equivalence set index value associated with the matching entry to the
7 bitmap, otherwise, assigning a new equivalence set index value to the bitmap and placing
8 the bitmap in the equivalence set; and
9

10 associating the equivalence set index value with the first-level lookup table entry
11 associated with the respective network packet section's value.

1 6. (Original) The method of claim 4 wherein the step of merging the equivalence sets
2 for each level to produce one or more next-level lookup tables and next-level equivalence
3 sets, comprises the steps of:

4 a) calculating the cross-product of a first bitmap associated with a first equivalence set and a second bitmap associated with a second equivalence set to produce a third
5 bitmap;
6

7 b) determining if the third bitmap matches an entry in the next-level equivalence
8 set and, if so, assigning an equivalence set index value associated with the matching entry
9 to the third bitmap, otherwise, assigning a new equivalence set index value to the third
10 bitmap and placing the third bitmap in the equivalence set;

11 c) associating a next-level lookup table entry with the equivalence set index value;
12 and

13 d) repeating steps a through c for all entries in the first equivalence set and all the
14 entries in the second equivalence set.

1 7. (Original) The method of claim 1 further comprising the step of:
2 associating each entry in the final equivalence set with one or more classes.

1 8. (Original) The method of claim 1 further comprising the step of:
2 transferring the lookup tables and final equivalence set to a network device that
3 performs packet classification.

1 9. (Original) A method for generating lookup tables, a final equivalence set and a re-
2 sults table for use in classifying a network packet in accordance with one or more match
3 statements, the match statements being one of a stand-alone matching rule and a match-
4 ing rule in an access control list (ACL) defining one or more matching rules, the method
5 comprising the steps of:

6 generating a super class that contains all of the matching rules;
7 converting the matching rules of the super class into a single, hierarchical ar-
8 rangement of lookup tables and equivalence sets, the hierarchical arrangement having a
9 plurality of levels including a first level and a final level, the final equivalence set being
10 associated with the equivalence set of the final level; and
11 generating the results table from the entries in the final equivalence set.

1 10. (Original) The method of claim 9 wherein each entry in the final equivalence set is
2 associated with an equivalence set index value and the step of generating the results table
3 from the entries in the final equivalence set, comprises the step of:
4 associating the equivalence set index value with a result associated with the
5 packet.

- 1 11. (Original) The method of claim 9 further comprising the step of:
2 transferring the lookup tables and final equivalence set to a network device that
3 performs packet classification.
- 1 12. (Original) A method for classifying a network packet in accordance with a policy
2 that specifies one or more classes, each class containing one or more match statements,
3 the match statements being one of a stand-alone matching rule and a matching rule in an
4 access control list (ACL) defining one or more matching rules, the method comprising
5 the steps of:
6 generating a super class that contains all of the matching rules;
7 saving class information associated with each class;
1 converting the matching rules of the super class into a single, hierarchical ar-
2 rangement of lookup tables and associated equivalence sets, the hierarchical arrangement
3 having a plurality of levels including a first level and a final level, a final equivalence set
4 being associated with the final level;
5 applying the network packet to the lookup tables to generate an outcome index;
6 applying the outcome index to the final equivalence set to generate a bitmap
7 value; and
8 associating the bitmap value with the saved class information to determine one or
9 more classes associated with the network packet.
- 1 13. (Original) The method of claim 12 further comprising the step of:
2 dividing the network packet into a plurality of sections.
- 1 14. (Original) A method for classifying a network packet in accordance with one or more
2 match statements, the match statements being one of a stand-alone matching rule and a
3 matching rule in an access control list (ACL) defining a plurality of matching rules, the
4 method comprising the steps of:

5 generating a super class that contains all of the matching rules;
6 converting the matching rules of the super class into a single, hierarchical ar-
7 rangement of lookup tables, the hierarchical arrangement having a plurality of levels in-
8 cluding a first level and a final level, a final equivalence set being associated with the fi-
9 nal level;
10 generating a results table from entries in the final equivalence set;
11 applying the network packet to the lookup tables to generate an outcome index;
12 and
13 applying the outcome index to the results table to determine a result that applies to
14 the network packet.

1 15. (Original) The method of claim 14 wherein the result is a pointer to a class associated
2 with the network packet.

1 16. (Original) The method of claim 14 wherein the result is a pointer to a matching rule
2 associated with the network packet.

1 17. (Original) The method of claim 14 further comprising the step of:
2 dividing the network packet into a plurality of sections.

1 18. (Original) An apparatus for generating lookup tables and a final equivalence set for
2 use in classifying a network packet in accordance with a policy having one or more
3 classes, each class containing one or more match statements, the match statements being
4 one of a stand-alone matching rule and a matching rule in an access control list (ACL)
5 defining one or more matching rules, comprising:

6 a processor;

7 a memory coupled to the processor; and

8 means for generating a super class that contains all of the matching rules associ-
9 ated with the classes;

10 whereby the processor is configured to a) convert the matching rules of the super
11 class into a single, hierarchical arrangement of lookup tables and equivalence sets, the
12 hierarchical arrangement having a plurality of levels including a first level and a final
13 level, the final equivalence set being associated with the final level and b) place the
14 lookup tables and final equivalence set in the memory.

1 19. (Original) The apparatus of claim 18 further comprising:

2 a content-addressable memory (CAM);

3 whereby the processor is configured to place the lookup tables in the CAM.

1 20. (Original) An apparatus for generating lookup tables, a final equivalence set and a

2 results table for use in classifying a network packet in accordance with one or more

3 match statements, the match statements being one of a stand-alone matching rule and a

4 matching rule in an access control list (ACL) defining a plurality of matching rules, com-
5 prising:

6 a processor;

7 a memory coupled to the processor; and

8 means for generating a super class that contains all of the matching rules;

9 whereby the processor is configured to a) convert the matching rules of the super
10 class into a single, hierarchical arrangement of lookup tables and equivalence sets, the
11 hierarchical arrangement having a plurality of levels including a first level and a final
12 level, the final equivalence set being associated with the final level, b) place the lookup
13 tables and final equivalence set in the memory, and c) generate the results table from en-
14 tries in the final equivalence set.

1 21. (Original) The apparatus of claim 20 further comprising:

2 a content-addressable memory (CAM);

3 whereby the processor is configured to place the lookup tables in the CAM.

1 22. (Original) A network device for classifying a network packet in accordance with a
2 policy having one or more classes, each class containing one or more match statements,
3 the match statements being one of a stand-alone matching rule and a matching rule in an
4 access control list (ACL) defining a plurality of matching rules, the network device comprising:
5

6 means for generating a super class that contains all of the matching rules associated with the classes;
7

8 means for saving class information associated with each class;

9 means for converting the matching rules of the super class into a single, hierarchical
10 arrangement of lookup tables and equivalence sets, the hierarchical arrangement having
11 a plurality of levels including a first level and a final level, a final equivalence set being
12 associated with the final level;

13 means for applying the network packet to the lookup tables to generate an outcome index;
14

15 means for applying the outcome index to the final equivalence set to generate a
16 bitmap value; and

17 means for associating the bitmap value with the saved class information to determine one or more classes associated with the network packet.
18

1 23. (Original) A network device for classifying a network packet in accordance with one
2 or more match statements, the match statements being one of a stand-alone matching rule
3 and a matching rule in an access control list (ACL) defining a plurality of matching rules,
4 the network device comprising:

5 means for generating a super class that contains all of the matching rules;

6 means for converting the matching rules of the super class into a single, hierarchical
7 arrangement of lookup tables and equivalence sets, the hierarchical arrangement having
8 a plurality of levels including a first level and a final level, a final equivalence set being
9 associated with the final level;

10 means for generating a results table from entries in the final equivalence set;

11 means for applying the network packet to the lookup tables associated with the
12 first level to generate an outcome index; and

13 means for applying the outcome index to the results table to determine a result
14 that applies to the network packet.

1 24. (Currently Amended) A computer readable media comprising:
2 the computer readable media containing computer executable instructions for
3 execution in a processor for the practice of ~~the method of claim 1~~ generating lookup ta-
4 bles and a final equivalence set for use in classifying a network packet in accordance with
5 a policy that specifies one or more classes, each class containing one or more match
6 statements, the match statements being one of a stand-alone matching rule and a match-
7 ing rule in an access control list (ACL) defining one or more matching rules, comprising,
8 generating a super class that contains all of the matching rules associated with the
9 classes specified by the policy; and
10 converting the matching rules of the super class into a single, hierarchical ar-
11 rangement of lookup tables and associated equivalence sets, the hierarchical arrangement
12 having a plurality of levels including a first level and a final level, the final equivalence
13 set being associated with the final level.

1 25. (Currently Amended) A computer readable media comprising:
2 the computer readable media containing computer executable instructions for execution
3 in a processor for the practice of ~~the method of claim 9~~ generating lookup tables, a final
4 equivalence set and a results table for use in classifying a network packet in accordance
5 with one or more match statements, the match statements being one of a stand-alone
6 matching rule and a matching rule in an access control list (ACL) defining one or more
7 matching rules, comprising,
8 generating a super class that contains all of the matching rules;
9 converting the matching rules of the super class into a single, hierarchical ar-
10 rangement of lookup tables and equivalence sets, the hierarchical arrangement having a

11 plurality of levels including a first level and a final level, the final equivalence set being
12 associated with the equivalence set of the final level; and
13 generating the results table from the entries in the final equivalence set.

1 26. (Currently Amended) A computer readable media comprising:
2 the computer readable media containing computer executable instructions for execution
3 in a processor for the practice of ~~the method of claim 12~~ classifying a network packet in
4 accordance with a policy that specifies one or more classes, each class containing one or
5 more match statements, the match statements being one of a stand-alone matching rule
6 and a matching rule in an access control list (ACL) defining one or more matching rules,
7 comprising,
8 generating a super class that contains all of the matching rules;
9 saving class information associated with each class;
1 converting the matching rules of the super class into a single, hierarchical ar-
2 rangement of lookup tables and associated equivalence sets, the hierarchical arrangement
3 having a plurality of levels including a first level and a final level, a final equivalence set
4 being associated with the final level;
5 applying the network packet to the lookup tables to generate an outcome index;
6 applying the outcome index to the final equivalence set to generate a bitmap
7 value; and
8 associating the bitmap value with the saved class information to determine one or
9 more classes associated with the network packet.

1 27. (Currently Amended) A computer readable media comprising:
2 the computer readable media containing computer executable instructions for execution
3 in a processor for the practice of ~~the method of claim 14~~ classifying a network packet in
4 accordance with one or more match statements, the match statements being one of a
5 stand-alone matching rule and a matching rule in an access control list (ACL) defining a
6 plurality of matching rules, comprising,

7 generating a super class that contains all of the matching rules;
8 converting the matching rules of the super class into a single, hierarchical ar-
9 rangement of lookup tables, the hierarchical arrangement having a plurality of levels in-
10 cluding a first level and a final level, a final equivalence set being associated with the fi-
11 nal level;
12 generating a results table from entries in the final equivalence set;
13 applying the network packet to the lookup tables to generate an outcome index;
14 and
15 applying the outcome index to the results table to determine a result that applies to
16 the network packet.

Please add new claims 28 et al.

1 28. (New) A method for generating lookup tables, the method comprising the steps of:
2 generating a super class that contains a plurality of matching rules for sorting in-
3 coming packets into classes;
4 converting the plurality of matching rules of the super class into a single, hierar-
5 chical arrangement of lookup tables and equivalence sets; and
6 generating the lookup table in response to the hierarchical arrangement of lookup
7 tables and equivalence sets.

1 29. (New) The method of claim 28 further comprising the step of:
2 transferring the lookup tables and the final equivalence set to a network device
3 that performs packet classification.

1 30. (New) An apparatus for generating lookup tables, comprising:
2 means for generating a super class that contains a plurality of matching rules for
3 sorting incoming packets into classes;
4 means for converting the plurality of matching rules of the super class into a sin-
5 gle, hierarchical arrangement of lookup tables and equivalence sets; and
6 means for generating the lookup table in response to the hierarchical arrangement
7 of lookup tables and equivalence sets.

1 31. (New) The apparatus claim 30 further comprising:
2 means for transferring the lookup tables and the final equivalence set to a network
3 device that performs packet classification.

1 32. (New) A system for generating lookup tables, comprising:
2 a processor configured to generate a super class that contains a plurality of match-
3 ing rules for sorting incoming packets into classes;

4 the processor further configured to convert the plurality of matching rules of the
5 super class into a single, hierarchical arrangement of lookup tables and equivalence sets;
6 the processor further configured to generate the lookup table in response to the
7 hierarchical arrangement of lookup tables and equivalence sets; and
8 a memory coupled to the processor, the memory configured to store the lookup
9 table.

1 33. (New) A computer readable media comprising:
2 the computer readable media containing computer executable instructions for execution
3 in a processor for the practice of generating lookup tables, comprising,
4 generating a super class that contains a plurality of matching rules for sorting in-
5 coming packets into classes;
6 converting the plurality of matching rules of the super class into a single, hierar-
7 chical arrangement of lookup tables and equivalence sets; and
8 generating the lookup table in response to the hierarchical arrangement of lookup
9 tables and equivalence sets.